ARCTIC SURVEYS

PROJECT NUMBER 6600-76-1

MARCH - MAY, 1974

J.H. WILSON

HYDROGRAPHER-IN-CHARGE

TABLE OF CONTENTS

PERSONNEL

J. Wilson	Hydrographer	Mar. 7 to May 16
D. MacDougall	Hydrographer	Mar.21 to May 16
C. Gorski	Hydrographer	Mar. 7 to Apr.16
B. Power	Hydrographer	Mar. 5 to May 12
R. Langford	Hydrographer	Apr.17 to May 17
M. Crutchlow	Hydrographer	Mar. 5 to Mar.28
P. Millette	Electronics Technician	Mar. 7 to May 14
J. McGirr	Gas Engineer	Mar. 5 to May 17
R. Smith	Cook	Mar. 7 to May 17
M. Voss	Dominion Helicopter 206B, Pilot	Mar. 7 to May 12
W. Henderson	Dominion Helicopter 206B, Pilot	Mar. 7 to May 12
S. Smith	Dominion Helicopter 206B, pilot	Mar. 7 to May 14
M. Hobbs	Dominion Helicopter 206B, Engineer	Mar. 7 to May 2
T. Van Ruben	Dominion Helicopter 206B, Engineer	Mar. 7 to May 2
D. Davidson	Dominion Helicopter 206B, Engineer	Mar. 7 to Apr. 9
D. Williamson	Dominion Helicopter 206B, Engineer	May 2 to May 16
J. LeRoux	Dominion Helicopter 206B, Engineer	Apr.20 to May 16
C. Arnott	Dominion Helicopter 206B, Engineer	May 2 to May 16
W. Hopper	Dominion Helicopter 206B, Engineer	May 2 to May 16

VISITORS

A. Kerr	Regional Hydrographer, Central Region	Mar.26 to Mar. 29
M. Singleton	Dominion Pegasus Radio Technician - two visits -	late Mar.& early Apr.
F. Hunt	P.C.S.P. Field Supervisor	April 5
A. Alt	P.C.S.P. Resolute Camp Manager	April 5
G. Hobson	P.C.S.P. Coordinator accompanied by an E.M.R. photographer and a Western University Professor	May 3
T. Jones	Dominion Pegasus Safety Officer	May 11
J. Deevers and Assistant,	M.O.T. Accident Investigators	May 11

MAJOR EQUIPMENT

Aircraft

3 - 206B Bell Helicopters for duration of the survey
1 - Twin Otter periodically
1 - D.C.-3 Freighter periodically

Electronic and Survey Equipment

3 only 9040 Edo Sounders - metric
1 only Gifft Sounder - not used
2 only Motorola R.P.S. chains
4 only M.R.A.-3 Tellurometers
3 only Wild T-2 Theodolites
1 only Wild T-3 Theodolite
1 only N.A.-2 Level
1 only CH-25 radiotransceiver
4 only Motorola P.T.-300 radiotransceivers
2 only Motorola P.T.-400 radiotransceivers

Camping Equipment

4 only Parcoll Tents (2-6 section, 1-5 section and 1-4 section)
1 only Longhouse Tent
1 only Igloo Tent
1 only 5 K.W. Lister generator
Miscellaneous Arctic Field Equipment

CHRONOLOGY OF EVENTS

March 5	-	Advance party departs Burlington for Resolute, N.W.T.
March 8 - 15	-	Establishing camp in West Fiord. Temperatures - 45°F to -55°F.
March 17	-	Commenced sounding on Southern half of Eureka Sound.
April 15	-	Sounding on Southern Eureka Sound completed Commenced breaking camp..
April 16 - 18	-	Moved camp to Eureka.
April 19	-	Commenced sounding on Greely Fiord and Northern Eureka Sound.
May 7	-	Helicopter, C.F.-P.O.M. engine failure at 100 ft. Helicopter, C.F.-K.O.V. crashed on Nansen Sound. Sounding operations ceased.
May 11	-	Helicopter, C.F.-P.O.M. and one hydrographer to King Christian Island to join Geological Survey of Canada.
May 12 - 13	-	Breaking camp.
May 14 - 15	-	Inventory and storage of equipment at P.C.S.P. base, Resolute.
May 17	-	All staff returned home.

SUMMARY

Central Region's 1974 Arctic Survey was a continuation of our objective to completely chart the navigable waterways of the Arctic Islands.

This year Eureka Sound and adjacent fiords, Nansen Sound and part of Greely Fiord were charted.

The standard method of sounding over the ice (spot sounding) was used with utilization of three, 206B helicopters for transportation.

New control was established to supplement the existing topographic control.

The survey was carried out from two base camps, viz., West Fiord (Vesle Fiord) and Eureka.

NARRATIVE

Planning and Preparations

In November 1973, Mr. A. Mortimer of Pacific Region and myself attended the 'Polar Continental Shelf Project' general meeting in Ottawa at which time we submitted what Central Region had planned for Arctic surveys in 1974 and what support we required from the Polar Shelf Project.

Polar Shelf agreed to supply us with the following:

1) 3 - 206 B helicopters with a total of 1050 hours.
2) 1 - Twin Otter periodically for 85 hours.
3) 1 - D.C.-3 freighter aircraft on an opportunity basis to mobilize and break camp.
4) All fuel required for aircraft and camps.
5) 2 - snowmobiles.
6) 2 - parcols (1 6-section and 1 4-section).
7) 1 - 5 KW Lister generator and other camping gear.
8) Salaries for 1 cook, 1 labourer and 1 gas-diesel mechanic.
9) Cost of design, fabrication and flight testing of instrument racks.

Job descriptions for a cook and labourer were drawn up and their positions were classified within the branch. We were to hire these men and Polar Shelf was to reimburse us for their salaries by journal voucher.

It was decided to use three, 206 B helicopters instead of the combination of one 205 and one 206 B which was used in 1973 on the Norwegian Bay survey.

The survey instrumentation setup in the 206 B helicopter in 1973 was unsatisfactory because of its location on the aft port passenger seat.

The hydrographer had very little space, and the Motorola R.P.S. consul was in such a low position that it was difficult to monitor.

The instrumentation rack and its location was completely redesigned for the 1974 winter field season.

Master Engineering Company was contracted to design and supply drawings for the new racks and Dominion Pegasus Co. fabricated and fitted the racks in the 206 B helicopters.

A holding bracket for an omni directional antenna was also designed and fabricated for each of the two aircraft.

Flight tests were flown at Dominion Pegasus in King City, Ontario in late February and the installations were given Ministry of Transport approval.

All Arctic clothing was drawn from Canada Centre for Inland Waters' stores.

The surveying equipment and camping equipment were drawn from Marine Sciences stores. An agreement was made with P.C.S.P. whereby we could ship our equipment with their freight shipment and thus cut down on air freight costs. Our equipment went by departmental truck to Ottawa, P.C.S.P. truck to Yellowknife via Ottawa, and on to Resolute by P.C.S.P. charter aircraft. An hydrographer, Mr. B. Power, assisted P.C.S.P. personnel in expediting the equipment in Yellowknife.

All non perishable food, (canned goods, etc.) were ordered from the Hudson's Bay Store in Yellowknife; arrangements were made with Dominion Stores warehouse in Montreal to have meats and fresh foods forwarded to Resolute periodically. The food was the best of quality and only a couple of sacks of potatoes failed to reach us.

Lumber for the camp setup was ordered from a local supply company in Yellowknife.

In early February the four Tellurometers were field tested on a known baseline along Lake Ontario.

Topographic photo-plots, photographs and station descriptions for the survey area were ordered from Marine Sciences, Headquarters in Ottawa.

Preliminary plots on a U.T.M. projection, at natural scale of 1:100,000 were drawn for the survey area on our Gerber plotter at Burlington.

OPERATIONS

Logistics

All personnel were in the field by March 7. On March 8 a reconnaissance flight of the survey area was made and a campsite was chosen on the shore of a small lake at the east end of West Fiord. (Latitude 79°-01'N., Longitude 83°-17'W.)

A total of seven D.C.-3 aircraft loads were required to move the equipment from Resolute to the camp site. Due to the severe cold temperatures (-45°F to -55°F) it took a week to get the camp operational. While the camp was being established, the R.P.S. Motorola system and sonar equipment were made operational in the helicopters and field tested in the Resolute area.

From this camp, Eureka Sound and adjacent fiords were surveyed from the South end of Eureka Sound, including Trold Fiord, Blind Fiord and adjacent fiords to latitude 79°-25'N. These areas were sounded on a two kilometre grid and less where required.

While surveying this area, fuel caches were established by the Twin Otter, at Trappers Cove, Wolf Fiord and Blind Fiord. Fuel was transported into the main camp by the D.C.-3 aircraft; first in forty-five gallon drums and then in a bladder and pumped into the empty drums. On each return trip the aircraft made to Resolute, empty drums and garbage were sent back.

Fresh water was drawn from the lake and hauled to the camp with the two skidoos.

On April 17 and 18, the camp in its entirety was moved and erected along the airstrip at Eureka. Thanks to the 'Dominion Pegasus' air crew's assistance, only two days of survey production were lost.

Six D.C.-3 aircraft loads were required to move the camp.

From the Eureka camp, Northern Eureka Sound, Borup Fiord, Nansen Sound and part of Greely Fiord were surveyed.

Fuel was slung with a 206 B helicopter to the new camp along the airstrip from the P.C.S.P. cache at the weather station. Two fuel caches were established along the West side of Nansen Sound and one in Borup Fiord.

On May 11, one hydrographer and helicopter flew to King Christian Island to join a geological survey party. They accomplished two days sounding between Ellef Ringnes Island and Amund Ringnes Island.

The Eureka camp was dismantled and freighted back to Resolute by four trips with the D.C. -3 aircraft on May 12 and 13.

In Resolute, an inventory was made of all field equipment and stored in the P.C.S.P. storage shed or shipped back to Burlington.

During the survey, weather observations were recorded twice daily and passed on to a P.C.S.P. meteorologist in Resolute.

All personnel had returned home by May 17.

Season completed.

Bathymetry

Sounding commenced on March 17. Eureka Sound and adjacent fiords, Trold Fiord, Blind Fiord and Borup Fiord were sounded on a two kilometre grid and less wherever shallows appeared such as Fulmar channel and the North East side of Stor Island. These two areas were covered on a one kilometre grid and less.

Nansen Sound and Greely Fiord proved to be deep thus these areas were sounded on a four kilometre grid from the East side of Canon Fiord, Longitude 81°15'W., West along Greely and Northwest on Nansen to Latitude 81°15'N.

A few shoal areas were discovered, but, the following three were the most interesting and possibly hazardous:

1) a two (2) metre shoal (Latitude 78°54'42" Longitude 86°-37'-00") 2.7 kilometres W.N.W.of the S.W. tip of Stor Island.
2) a seven (7) metre shoal (Latitude 78°-29'-05"N. Longitude 88°-34'-20" W.) in Wolfe Fiord with 50+ metres around it.
3) a twenty-five (25) metre shoal (Latitude 78°-02'-53"N. Longitude 85°-42'-40" W.), one-third of the way across the entrance of Trold Fiord, dropped off to two hundred (200)+ metres.

All soundings were reduced by two metres.

Four of the smaller fiords in the survey area (the three fiords off the East side of Trold Fiord and Gibs Fiord) were found to have distinct ridges across their entrances. The soundings across the entrance of 'Starfish Bay' were the best illustration of siltation. Soundings could not be obtained on the south half of the entrance probably because the ice was touching bottom, and at the centre of the entrance twenty-three metres of water was recorded with depths dropping off to a maximum of 328 metres, halfway back in the Bay.

The echo sounders were calibrated with a bar lowered one hundred metres through a hole in the ice. This was done at two different locations and at each location, the bottom depth was noted and the location of the hole was marked. Periodically the sounders were checked at these locations using the noted bottom depths as a reference point.

A total of 4189 soundings were completed with a utilization of 1037 hours on the three 206 B helicopters.

On the Geological Survey, a total of 152 soundings were completed.

Control

In past Hydrographic Arctic Surveys, control was usually established the year previous to the sounding operation. This year, control was done in conjunction with the sounding. In some areas it was difficult to keep the control ahead of the sounding operation and thus some stations were photo fixed or positioned by R.P.S. Motorola and later tied into the control net whenever time permitted.

A total of twenty-two new stations were established. Traversing was done along the entrance of Trold Fiord and along Bay Fiord. The control stations in the other areas were tied in by trilateration with at least three Tellurometer distances to each station.

Some of the Tellurometer distances over the ice exhibited large swings in the fine readings. On a couple of the shots the fine readings varied by six metres but the variation was usually two or three metres.

One of the shots (25 Kms.) was measured three times and the spread over the reduced distances was 1.2 metres.

The null metres did not waver as usually happens when there are reflections and erecting the instruments on the ground didn't appear to make any difference.

A shot over land on a known baseline proved that the instruments were operating properly.

Doing control work in extreme cold temperatures ($-20^{\circ}F$ to $-40^{\circ}F$) is not efficient. These temperatures with a slight breeze made observing very difficult; thus, trilateration was done wherever possible.

Positioning Systems

Motorola Range Positioning Systems (R.P.S.) were installed in two of the 206 B helicopters.

The new instrument racks for these positioning systems proved out well indeed. The R.P.S. range consul and multiplexer were positioned in a rack in the front left passenger position. The panel on the back of the forward port seat was on hinges and thus swung out of the way to enable the hydrographer in the starboard aft section to have a clear view of the range consul.

Omni antennas were evaluated on both the machines, but were later changed for the radome antennas. Using the omnis, a range of thirty-seven kilometres was reached, but even at closer ranges many erratic readings were obtained and sometimes it would require up to a minute to up date. With the radome antennas there were no problems and at a range of eighty-five kilometres a good signal was received.

With the radomes, long ranges were received but one drawback with the radome antennas was that the helicopters had to work in areas that didn't have line of sight between them or one would interfere with the other.

Each time the baselines were changed, the R.P.S. was re-calibrated over the baseline length.

Positioning was done by range/bearing in areas where coverage could not be obtained with range/range, i.e., areas that would have required a considerable amount more time spent in establishing horizontal control points for the range/range configuration.

Photo sounding was done in the small narrow fiords.

Very little time was lost due to breakdowns of the R.P.S. positioning systems.

Sounders

Three Edo 9040 echo sounders with 115.2 KHz crystals were utilized on the survey.

In each of the two helicopters used for sounding, the instruments were mounted on the newly designed racks, (on a 45° angle) on the port aft seat, facing the watchkeeper.

This setup gave the hydrographer ample room, plus a clear view of the graph, when he was outside the helicopter.

Our electronics technician designed and fabricated a remote gain box. This remote control was situated behind the aft starboard seat next to the door; thus the hydrographer did not have to climb back over the long range tanks into the helicopter each time he had to adjust the gain.

A few minor problems, such as broken transducer cables, fatigued transistors and unserviceability in the transducers occurred, but, thanks to the efforts of our technician and the speedy service of Marine Sciences personnel in Burlington, little time was lost due to these problems.

On the whole, the sounders worked well and a maximum depth of 898 metres, with a fairly good graph, was recorded on Nansen Sound. This was probably a record depth for soundings taken through the ice with an Edo 9040 echo sounder.

Helicopters

As mentioned previously, three 206 B helicopters were used for this survey instead of the combination of a 205 and a 206 which was used in the previous year in Norwegian Bay.

The two helicopters used for sounding were fitted with long range fuel tanks and the third machine had carrying racks on the side in lieu of the long range tanks. The third helicopter was used for horizontal control, changing the batteries at the remote R.P.S. sites, and for slinging of fuel, etc.

All three of the helicopters came equipped with 'Bleed' air heaters plus the regular heaters. These 'Bleed' air heaters were very efficient and kept the cabins at a comfortable temperature.

Until the crash of helicopter - K.O.V. only ½ day of production was lost on one machine due to mechanical breakdowns and this half day lost was due to a dead battery.

All the maintenance work by the engineers was carried out at night.

With the new instrumentation setup the hydrographer had ample space in the back seat to sit comfortably and have his associated sounding equipment in close proximity.

We had short range radio communication problems between the camp and the helicopters. Often they could reach far away stations through 'skips', but, could not contact the base camp which was on the average of 50 miles away or less.

A Dominion Pegasus radio technician was in the area on two occasions, but, the communications problem persisted until tne end of the survey.

The following two reasons were given for the above problem: 1) We were in the zone of silence. This is the distance between the end of the direct ground wave which is limited by the terrain, and the beginning of the first skip wave returning from the ionosphere. 2) There might have been a problem in the radiation pattern of the antenna. This was to have been checked out at Dominion Pegasus in King City, Ontario, but, we had not heard anything from them by the end of the survey.

The pilots turned off their sets for most of the operating time because of excessive noise on the receivers which was said to have been caused by the hot line of the long range tank fuel pumps.

Capacitors designed to filter out this noise were to have been sent up to us, but, we never received them.

Communication from helicopter D.J.T. was not readable (garbled) for the duration of the survey. The malfunctioning part in the radio was replaced a couple of days before the helicopter returned to Resolute.

Helicopter P.O.M. - Engine Failure

On May 7, the second last day of sounding, helicopter P.O.M. had an engine failure at 100 feet over Greely Fiord and auto-rotated to the ice surface. The pilot set the craft down without damaging the machine or injury to himself or his passenger, Mr. Langford. This pilot has been flying 206s for three years and this was his third engine failure and third auto-rotation without injury to himself or passengers. The engineers checked the machine over and were unable to come up with a cause for the engine failure.

The Dominion Pegasus Safety Officer stated that there have been many unexplained flame-outs on the 206 helicopters over the last year. Most 206s now have relight kits which are supposed to restart the engine if a flame-out

occurs. Only one of our machines had a relight kit.

Helicopter K.O.V. "Crash"

This same day, May 7, helicopter K.O.V. crashed into the ice on Nansen Sound. (Latitude 81° 17' 30") (Longitude 90° 50' 52"). Miraculously both men on board escaped death and serious injury. Mr. Power had his left wrist broken, right index finger dislocated, four teeth knocked out, a cut under his left knee requiring ten stitches, and a bruised left side with some internal bleeding. Mr. M. Voss, the pilot, received facial lacerations, frostbitten fingers, chipped teeth, and a cut on one leg. The helicopter was a complete write off.

The estimated cost of repairs or replacement of equipment, excluding the helicopter is approximately $8,000. The cause of the accident has not yet been determined and is still being investigated by the Ministry of Transport. They have determined that a 3-foot section came off the end of the main rotor blade.

Neither the Emergency Locator Transmitter nor the Emergency radio worked after the crash. The E.L.T. was supposed to trigger itself on impact but it couldn't even be activated manually by the pilot. A red indicator light on the E.L.T. confirmed that the batteries were good. Both the radio and E.L.T. had been checked out in mid-April. The radio was probably damaged in the crash as it wasn't wrapped up in anything protective.

The main radio was not tried because of the danger of starting a fire and explosion.

Mr. Power and Mr. Voss were taken to the American Forces Hospital in Thule, Greenland where they were hospitalized for three days before returning south. Mr. Power was in the hospital for approximately a week after returning to Ottawa.

The crash site was positioned by R.P.S.

After the M.O.T. investigators had finished their investigation at the crash site, the larger pieces of the wreckage were cut up and all parts were shipped back to Resolute in the Twin Otter aircraft.

Data Processing

This year the Field Sheets were drawn up on the Gerber Plotter, as was done last year. The base plot, the control, the soundings, the title and even the stamps were put on by the plotter.

The shoreline was done by hand.

The above process is very time consuming. Hours and hours are spent in preparing the data to go on tape and then in checking and correcting errors - human errors and machine errors. Each sounding requires one computer card.

CONCLUSIONS AND COMMENTS

The utilization of the three, 206 B helicopters, two for sounding and one for servicing remote sites plus other duties, is an efficient, and economic means of transportation for our Arctic Surveys.

If the survey was a combined operation with The Earth Physics Branch and R.P.S. Motorola was used as a positioning system, a larger helicopter would have to be considered as the 206 B would be overloaded.

A set of long range tanks should be available for the third helicopter to use while flying north and while moving within the Arctic. The tanks can be exchanged for the racks in the field in a short time with little difficulty.

Before the helicopters fly north for the 1975 season, it should be ensured that the radios on board are operating properly with special attention given to the ranges at which we were having problems.

In future surveys, it would be more efficient if the control could be established in the previous season. In some cases this might not be possible due to last minute changes in priorities. If this is the case, I would suggest that the survey party consist of five hydrographers, two to work on sounding, two on control and servicing transponder sites, and one in the office.

When we are in an area surveying, it would be an ideal time for an oceanographer to conduct some oceanographic studies. The platform is there at no cost and the third helicopter could be utilized for his transportation.

Self recording current meters could be put out and recovered without too much difficulty.

I suggest that for our Arctic Surveys where the survey data is not recorded on tape, that the soundings be put on the field sheets by hand.

NOTE OF THANKS

I wish to thank all the P.C.S.P. personnel and Marine Sciences personnel who were involved with this project, for their advice, support and hard work in making this survey a success. The extra efforts and the efficient logistic support given us by the P.C.S.P. Resolute camp manager, Mr. Fred Alt, were greatly appreciated.

APPENDIX I

- Statistics -

FIELD REPORT STATISTICS:- MONTHLY..... PROJECT..... FINAL FIELD XXX

YEAR 1974 FROM MARCH 5 TO MAY 16

Establishment ARCTIC SURVEY PARTY

H.I.C. J.H. WILSON

		Project Number	Project Number	Project Number	Project Number	
Project Name	EUREKA SOUND	6600-76-1				
Project Name						
Project Name						
Project Name						
Resources:						TOT
Number of Hydrographers	*	4/73				
Number of Scientists	*	-				
Number of Electronic Technicians	*	1/69				
No. of Student Assistants and Casuals	*	-				
No. of Support Personnel (Ship's Crew, Etc.)	*	8/73				
Total Personnel	*	13/73				
Number of Ships		-				
Number of Launches		-				
Number of Land Vehicles Skidoos		2				
Number (and type) of Aircraft		(see below)				
Number of Minor Support staff		2/73				
Other (specify)						
Aircraft						
Bell 206 B helicopters		3				
Twin Otter (periodically)		1				
D.C.-3 Freighter Aircraft (periodically)		1				

* Should provide two figures separated by a slash. The first figure being the average number on strength and the second being the man days.
e.g. number of Hydrographers: 5/100 (an average of 5 Hydrographers spent 100 man days on the project).

YEAR FROM TO

Establishment ARCTIC SURVEY PARTY H.I.C. J.H. WILSON	Project Number	Project Number	Project Number	Project Number	T
Time:					
Total operational days.	73				
Days actual field work.	45				
Days lost (weather)	8½				
Days lost (Sat. Sun. Holidays)	-				
Days lost (Equipment failure)	3½				
Days lost in Transit	4½				
Days lost in port for Supplies, Bunker, etc.	-				
Days lost, other causes	11½				
Total Man days in period (staff)	280				
Total Man days worked (staff)	280				
Man days:- (staff)					
(a) Sounding	80				
(b) Shoal Examinations	N/A				
(c) Wharf surveys	N/A				
(d) Oceanography	N/A				
(e) Geophysics	N/A				
(f) Tides & water levels	N/A				
(g) Collecting bottom samples	N/A				
(h) Horizontal Control	56				
(i) Shorelining & Low Watering	(Included in sounding man days)				
(j) Data processing & office admin.	62				
(k) Sailing directions	1				
(l) Place Names	N/A				
(m) Current observations	N/A				
(n) Photo-Ident.	Included with control				
(o) Others (specify)					
(p) Support operations	66				
(q) Travel	11				
(r) Down due to personal injuries	4				

FROM MAR 5 TO MAY 16

Establishment ARCTIC SURVEY PARTY H.I.C. J.H.WILSON	Project Number 6600-76-1	Project Number	Project Number	Project Number	T
Sounding (Linear Nautical Miles/KM):					
Ship Sounding	N/A				
Launch Sounding	N/A				
Other (specify) Spot Sounding	4189				
Total sounding					
Reconnaissance (Track) sounding	N/A				
Area sounded (Km^2)	12925				
Shoals Examined: Shoal Examinations (Ship)	N/A				
Shoal Examinations (Launch)					
Shoal Examinations (Sweep)					
Shoal Examinations (other) specify					
Shoal Examinations (Total)					
Navigational Aids: Shore Aids Positioned (including ranges)	N/A				
Floating Aids Positioned					
Navigational Ranges Sounded					
Navigational Ranges Drifted					
Sector Ranges Positioned					
Navigational Aids Established					

FROM [illegible] TO MAY 16.

Establishment ARCTIC SURVEY PARTY H.I.C. J.H. WILSON	Project Number	Project Number	Project Number	Project Number
Shore Control:				
Signals built	16			
Signals re-built	6			
Towers built	N/A			
Number of Stations occupied	19			
Number of Stations re-occupied	11			
Number of stations permanently marked	9			
Distance Traversed & Trilaterated (K.M.)	1380			
Number of Elevations Measured	71			
Number of Heights Measured	N/A			
Number of Stations Photo Ident.	11			
Other (specify)				
Stations Recovered	27			
New Stations Positioned	22			
Calibrations:				
No. of Calibration Stations:				
Lambda, Decca, Hi-Fix, Mini Fix,				
~~Loran, Decca Navigator,~~ Motorola Range Positioning System	37			
No. of B/c's marked and referenced	9			

FIELD REPORT STATISTICS:- MONTHLY ... PROJECT ... FINAL FIELD ...

YEAR FROM TO

Establishment H.I.C.	Project Number	Project Number	Project Number	Project Number
Tide and Current Data: Recording gauges established	N/A			
Recording gauges recovered				
Staff gauges established				
Bench Marks Recovered				
Bench Marks Established				
Bench Marks Levelled				
Distance Levelled (N.M.) (KM)				
No. of Current Meters Set Out				
No. of Current Meters recovered				
No. of hours of Current Measurements (Other than with Moored Meters)				
Oceanography: No. of Oceanographic stations	N/A			
Gravity Profiles-survey (N.M.)(KM)				
Gravity Profiles-track, (N.M.)(KM)				
Magnetic Profile-survey (N.M.) (KM)				
Magnetic Profile-track, (N.M.) (KM)				
Seismic Profile-survey (N.M.) (KM)				
Seismic Profile-track (N.M.) (KM)				
Number of Water Samples				

YEAR 1974 FROM MARCH 5 TO MAY 16

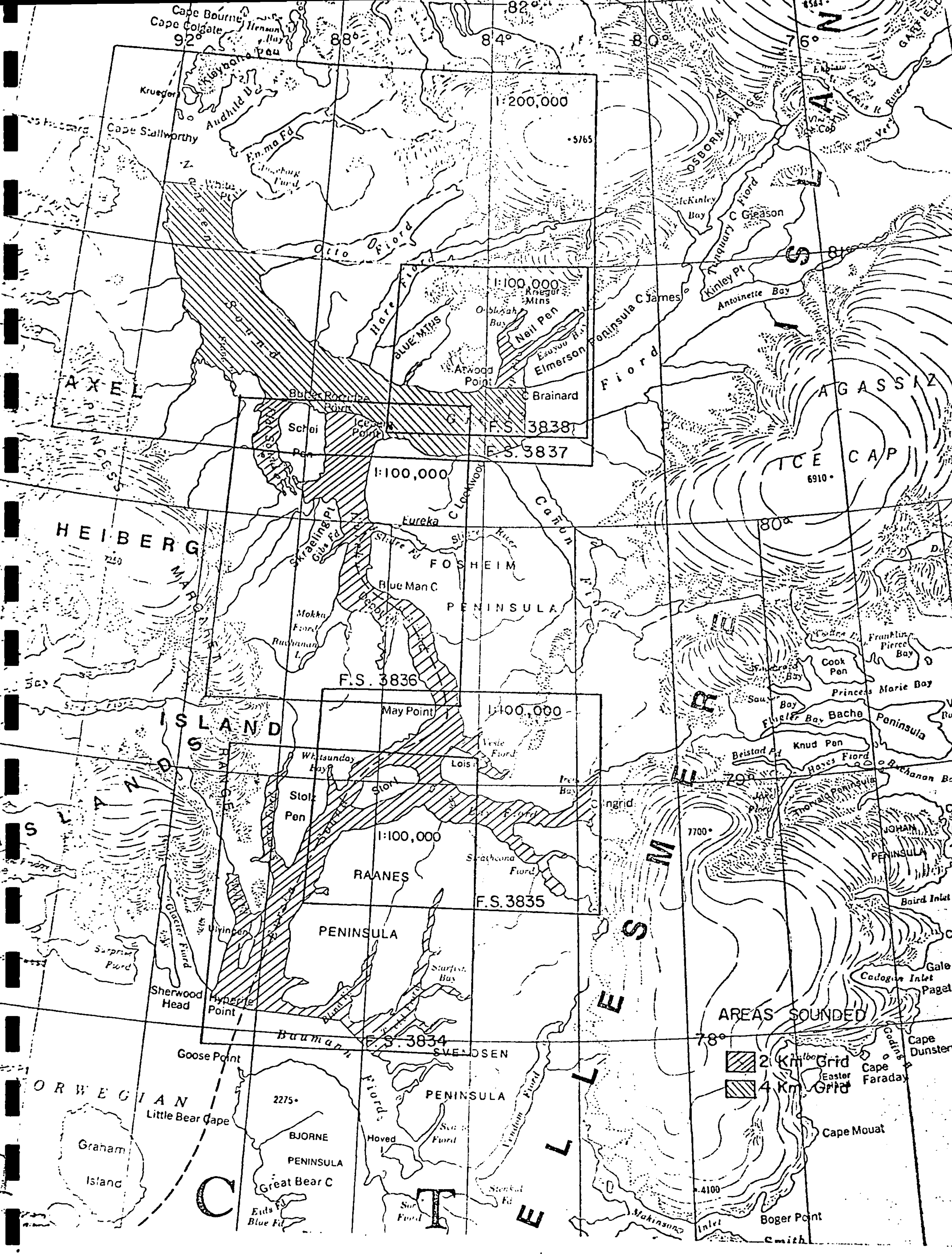
Establishment ARCTIC SURVEY PARTY H.I.C. J.H. WILSON	Project Number	Project Number	Project Number	Project Number	To
Bottom Samples:					
Number of bottom samples (Grab)	N/A				
No. of bottom samples (underway)					
No. of bottom samples (Armed Lead)					
No. of Cores					
No. of Samples retained					
Miscellaneous:					
No. of Dangers to Navigation, rocks Reefs, pilings, etc., fixed.	N/A				
Shoreline checked (N.M.) XXX	575				
Wharves surveyed	N/A				
No. of Reference buoys streamed	N/A				
No. of Reference buoys recovered	N/A				
No. of Shore Stations Established:					
Motorola R.P.S.	43				
Helicopter flying hours	1037				

YEAR FROM TO

Establishment: H.I.C.	Project Number	Project Number	Project Number	Project Number	To
Data submitted from the field: (Include file numbers:)	N/A				

APPENDIX II

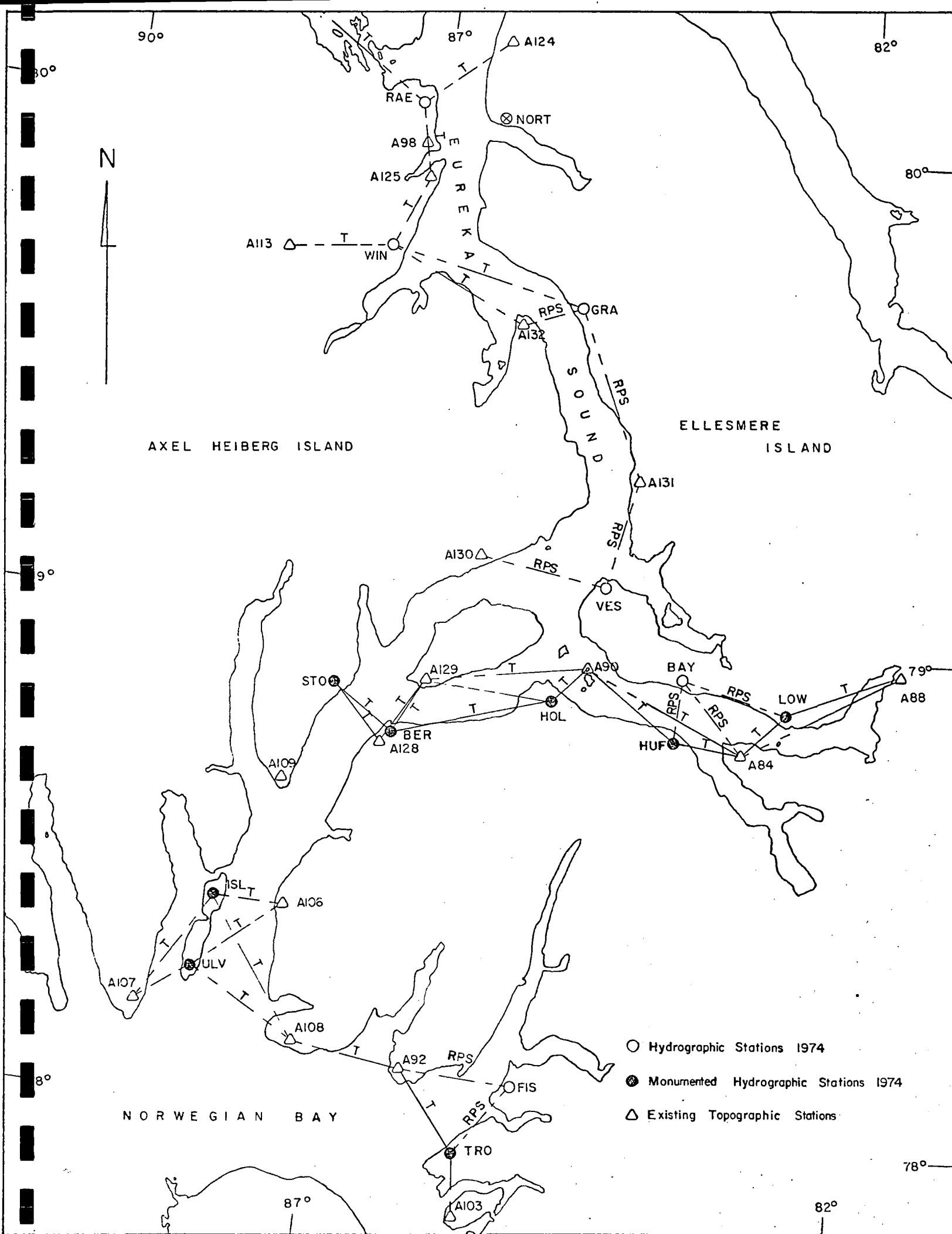
- FIELD SHEET LAYOUT AND AREA SOUNDED -

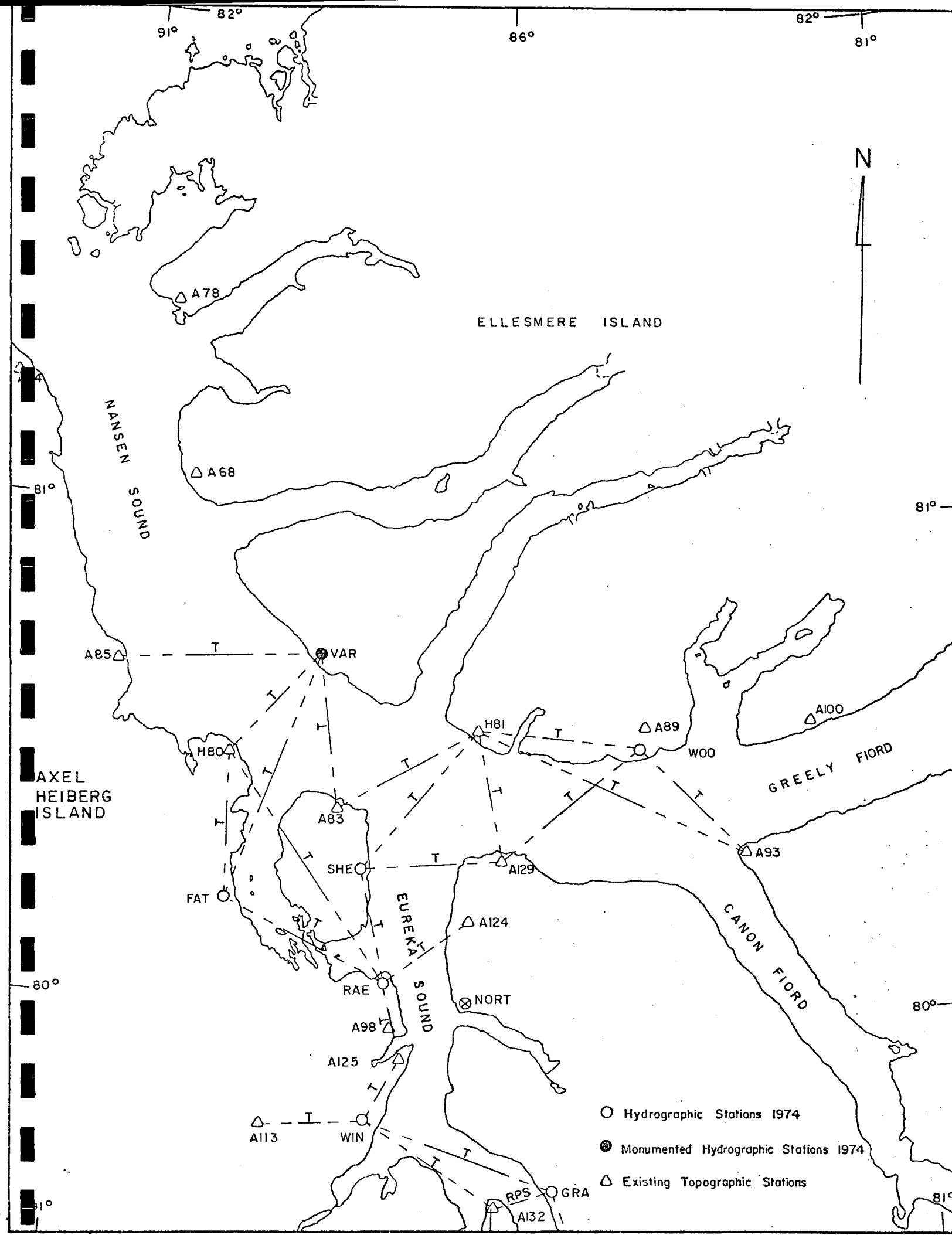


AREAS SOUNDED
2 Km Grid
4 Km Grid
F.S. 3838
F.S. 3837
F.S. 3836
F.S. 3835
F.S. 3834
1:200,000
1:100,000
1:100,000
1:100,000
1:100,000
AXEL HEIBERG ISLAND
ELLESMERE ISLAND
AGASSIZ ICE CAP
FOSHEIM PENINSULA
RAANES PENINSULA
SVENDSEN PENINSULA
BJORNE PENINSULA
NORWEGIAN
OSBORN RANGE
BLUE MTNS
Cape Bourne
Cape Colgate
Cape Stallworthy
Kruegor
Audhild B
Otto Fiord
Hare Fiord
Krieger Mtns
Neil Pen
Elmerson Peninsula
C James
C Gleason
Kinley Pt
Antoinette Bay
McKinley Bay
Tanquary Fiord
Atwood Point
C Brainard
Butter Porridge Point
Schei Pen
Iceberg Point
Eureka
C Lockwood
Skraeling Pt
Blue Man C
Mokka Fiord
Buchanan L
Cañon Fiord
May Point
Whitsunday Bay
Stolz Pen
Lois
Vesle Fiord
Iris Bay
Strathcona Fiord
Sherwood Head
Hyperite Point
Glacier Fiord
Surprise Fiord
Goose Point
Baumann Fiord
Little Bear Cape
Graham Island
Great Bear C
Hoved
Starfish Bay
Makinson Inlet
Boger Point
Cape Mouat
Cape Faraday
Cape Dunsten
Cadogan Inlet
Baird Inlet
Johan Peninsula
Thorvald Peninsula
Hayes Fiord
Knud Pen
Bache Peninsula
Princess Marie Bay
Flagler Bay
Beistad Fd
Cook Pen
Franklin Pierce Bay
Sawyer Bay
92°
88°
84°
80°
76°
82°
81°
80°
79°
78°
6910
5765
7700
4100
2275

APPENDIX III

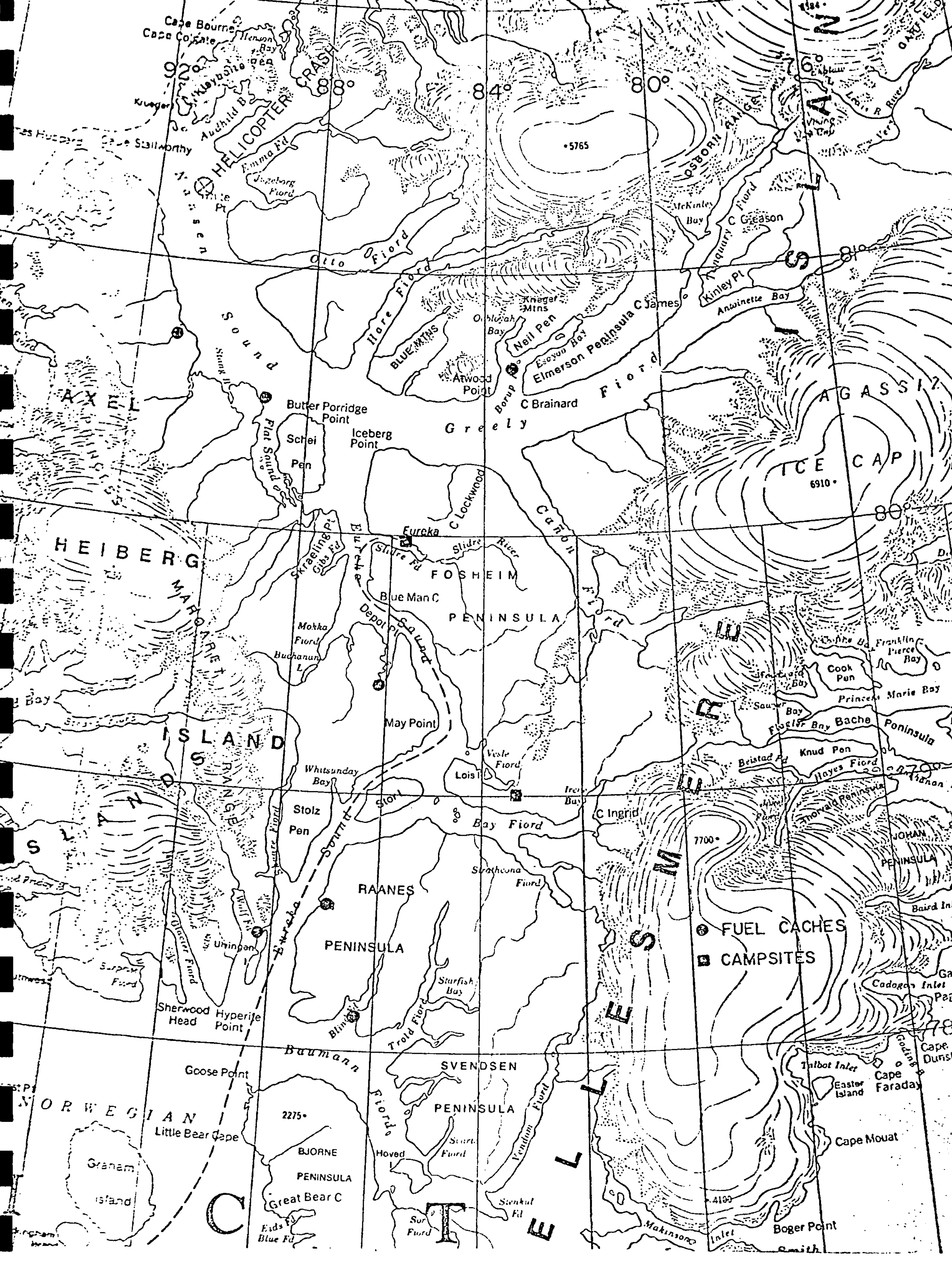
- HORIZONTAL CONTROL -


90°
87°
82°
80°
79°
78°
N
A124
RAE
NORT
A98
A125
A113
WIN
EUREKA SOUND
RPS
GRA
A132
AXEL HEIBERG ISLAND
ELLESMERE ISLAND
A131
A130
VES
STO
A129
A90
BAY
LOW
A88
HOL
BER
A128
HUF
A84
A109
ISL
A106
ULV
A107
A108
A92
FIS
TRO
A103
NORWEGIAN BAY
Hydrographic Stations 1974
Monumented Hydrographic Stations 1974
Existing Topographic Stations


91°
82°
86°
82°
81°
N
A78
ELLESMERE ISLAND
NANSEN SOUND
A68
81°
81°
A85
VAR
H81
A89
A100
H80
WOO
GREELY FIORD
AXEL HEIBERG ISLAND
A83
A93
SHE
A129
FAT
EUREKA SOUND
A124
CANON FIORD
80°
RAE
NORT
80°
A98
A125
A113
WIN
RPS
GRA
A132
81°
81°
Hydrographic Stations 1974
Monumented Hydrographic Stations 1974
Existing Topographic Stations

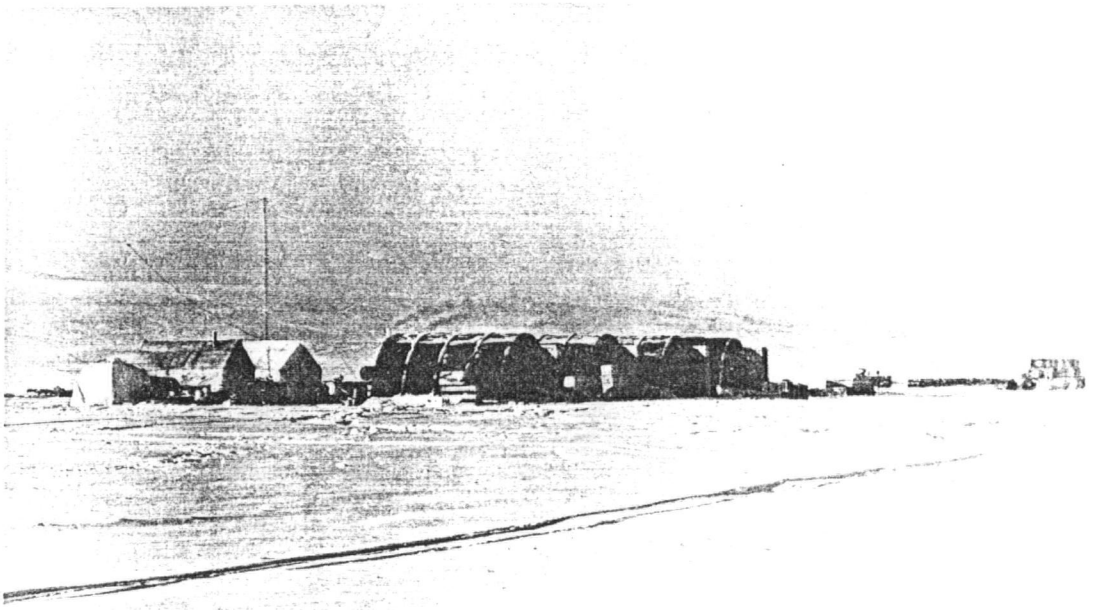
APPENDIX IV

- CAMPSITES, FUEL CACHE LOCATIONS AND HELICOPTER CRASH LOCATION -


Cape Bourne
Cape Colgate
Henson Bay
92°
88°
84°
80°
76°
HELICOPTER CRASH
Krueger
Audhild B
Emma Fd
Cape Stallworthy
Ingeborg Fiord
White Pt
Nansen Sound
5765
OSBORN RANGE
McKinley Bay
C Gleason
Tanquary Fiord
Otto Fiord
Hare Fiord
Krieger Mtns
Neil Pen
C James
Kinley Pt
Antoinette Bay
81°
BLUE MTNS
Oobloyah Bay
Atwood Point
Borup Pt
Eseyon Bay
Elmerson Peninsula
Fiord
C Brainard
AXEL
Butter Porridge Point
Iceberg Point
Greely
Schei Pen
Flat Sound
AGASSIZ
ICE CAP
6910
C Lockwood
Canon Fiord
80°
HEIBERG
Eureka
Slidre Fd
Slidre River
Skraeling Pt
Gibs Fd
FOSHEIM
Blue Man C
PENINSULA
MARGARET
Mokka Fiord
Depot Pt
Eureka Sound
Buchanan L
Cook Pen
Pierce Bay
Princess Marie Bay
Sawyer Bay
Bache Peninsula
Flagler Bay
Knud Pen
Beistad Fd
Hayes Fiord
May Point
ISLAND
RANGE
Whitsunday Bay
Vesle Fiord
Lois L
Irene Bay
79°
Stolz Pen
Stor I
Bay Fiord
C Ingrid
Thorvald Peninsula
JOHAN PENINSULA
7700
Strathcona Fiord
RAANES
PENINSULA
Wolf Fd
Glacier Fiord
Baird Inlet
FUEL CACHES
CAMPSITES
Surprise Fiord
Starfish Bay
Cadogan Inlet
Sherwood Head
Hyperite Point
Blind Fd
Trold Fiord
78°
Baumann Fiord
SVENDSEN
PENINSULA
Goose Point
Talbot Inlet
Cape Dunsterville
Easter Island
Cape Faraday
NORWEGIAN
2275
Little Bear Cape
BJORNE
PENINSULA
Hoved
Sor Fiord
Vendom Fiord
Cape Mouat
Graham Island
Great Bear C
Stenkul Fd
4100
Eids Fd
Blue Fd
Makinson Inlet
Boger Point
ELLESMERE

APPENDIX V

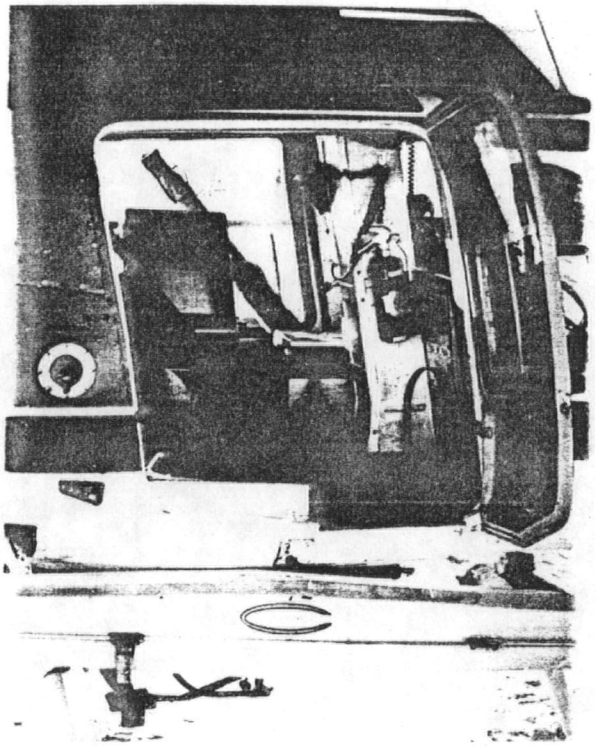
- PHOTOGRAPHS -



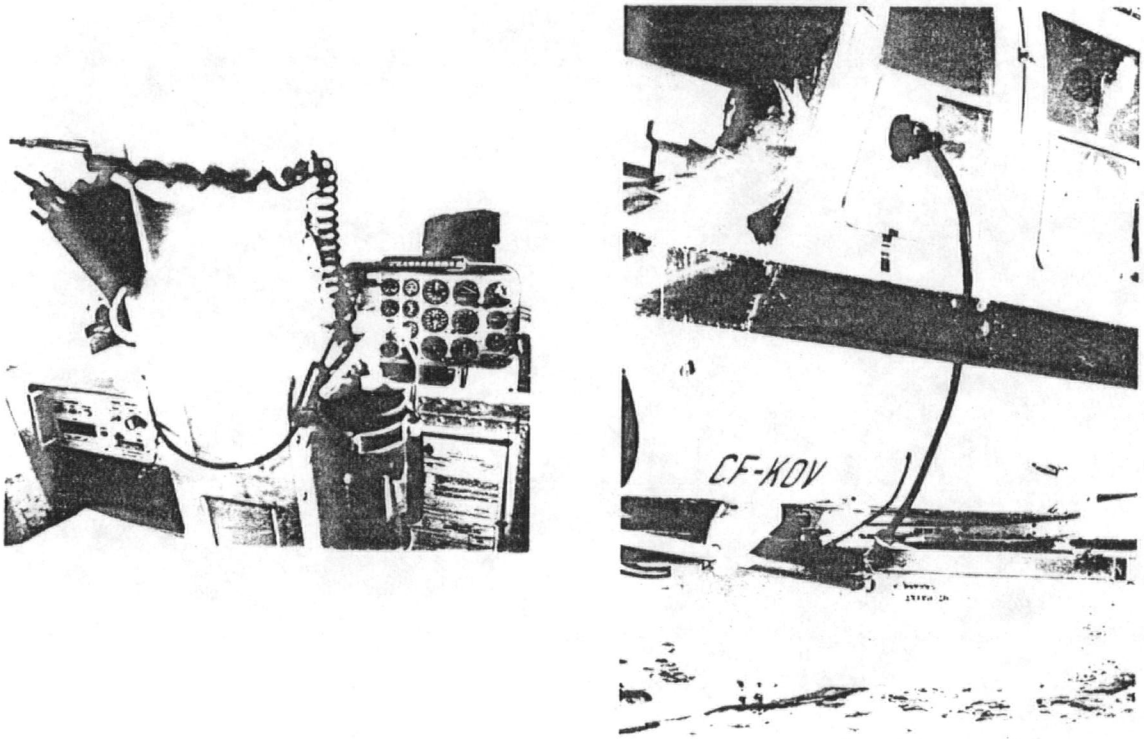
WEST FIORD CAMP

"HOME SWEET HOME"

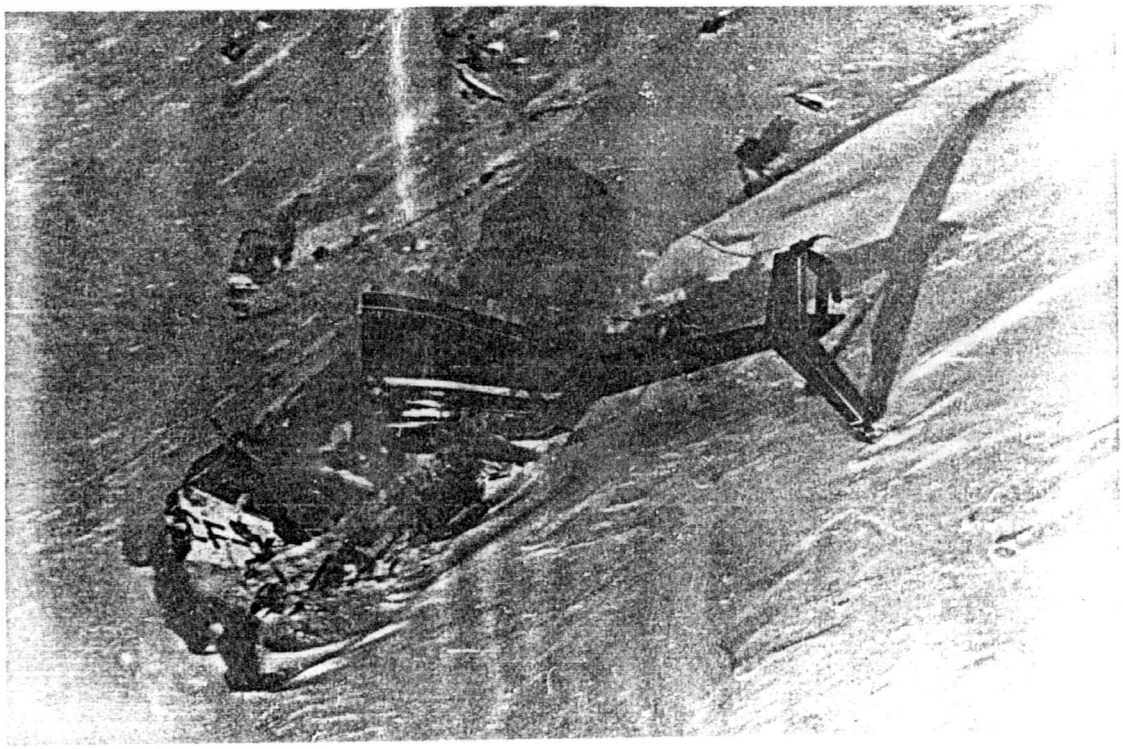
206 B HELICOPTERS



ECHO SOUNDER INSTALLATION



MOTOROLA RPS INSTALLATION



HELICOPTER K.O.V. CRASH

APPENDIX VI

- WEATHER OBSERVATIONS -

WEATHER REPORTS

Ceiling Classification's

- A Aircraft
- E Estimated
- P Precipitation
- W Indefinite

Sky Symbol

- ○ Clear
- ⦶ Scattered
- ⦶⦶ Broken
- ⊕ Overcast
- –X Partially Obscured
- X Obscured

°C	°F	°C	°F
-60	-76	-15	05
-55	-67	-10	14
-50	-58	-05	23
-45	-49	00	32
-40	-40	05	41
-35	-31	10	50
-30	-22	15	59
-25	-13	20	68
-20	-04	25	77

m/sec	knots	mph
00	00	00
03	04	05
05	10	09
08	15	13
10	20	17
13	25	22
15	30	26
18	35	30
20	40	35

Weather and Obstruction To Vision

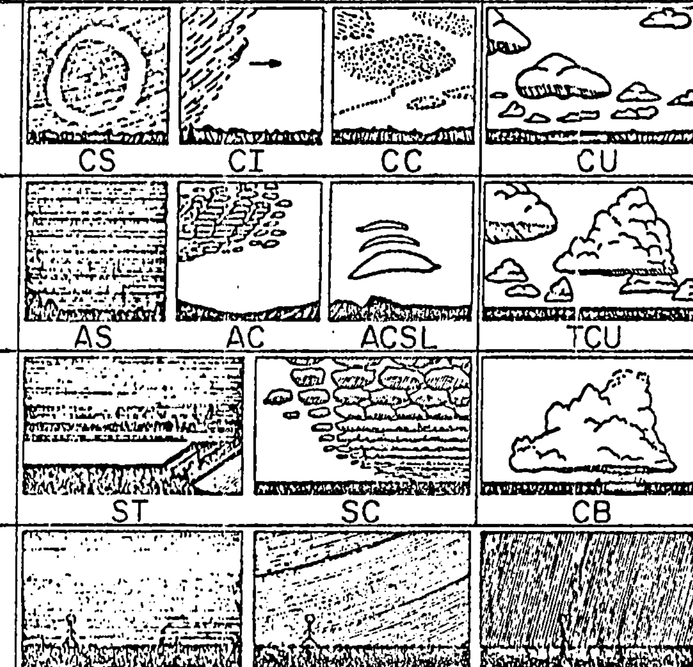
- L Drizzle
- ZL Freezing Drizzle
- R Rain
- ZR Freezing Rain
- RW Rain Showers
- S Snow
- SW Snow Showers
- SP Snow Pellets
- SG Snow Grains

very light	light	moderate	heavy
⁻			⁺

- F Fog
- IF Ice Fog
- IC Ice Crystals
- BS Blowing Snow

Wind Direction

- N = 36
- NNE = 02
- NE = 04
- ENE = 07
- E = 09
- ESE = 11
- SE = 13
- SSE = 16
- S = 18
- SSW = 20
- SW = 22
- WSW = 25
- W = 27
- WNW = 29
- NW = 32
- NNW = 34



Standard Height Range	Layer Cloud Stratoform	Layer Cloud Cumuloform		Vertically Developed Cloud
40,000 to 20,000 feet	CS	CI	CC	CU
20,000 to 6,500 feet	AS	AC	ACSL	TCU
6,500 to 0 feet	ST	SC		CB
Surface Based	F	BS		S or R

CS-cirostratus	CI-cirus	CC-cirocumulus	CU-cumulus
AS-altostratus	AC-altocumulus	ACSL-lenticular altocumulus	
NS-nimbostratus	SC-stratocumulus	SF-stratusfractus	TCU-towering cumulus
ST-stratus	BS-blowing snow	CF-cumulusfractus	
F-fog	S-snow	R-rain	CB-cumululo-nimbus

Abbreviations

- CIG Ceiling
- CLR Clear
- DFTG Drifting
- DMLY Dimly
- FPTCH Fog Patch
- F BNK Fog Bank
- FROIN Frost on Indicator
- INTMT Intermittent
- INVDG Invading
- LFTG Lifting
- LWR Lower
- MOVG Moving
- OCNL Occasion
- PIREP Pilot Report
- QUAD Quadrant
- SNW Snow
- VRBL Variable
- VSBY Visibility

Tendency

0, 1, 2, 3, 4, 5, 6, 7, 8

Date (LST) 27	Hour (LST) 20	Hour (GMT) 30	Sky Condition and/or Ceiling (100's ft.) 31	Visibility (miles) 32	Weather and Obstructions To Vision 33	Sea-level Pressure (mb) 34	Dry Bulb Temperature (°F) 35	Dew Point Temperature (°F) 36	Wind Dir. 00 to 36 37A	Wind Speed (mph) 30	Wind Character 39	Altimeter Setting (in.) 40	Clouds and/or Obscuring Phenomena Type, Amount 41	Remarks 42	Max Temperature (°F)	Min Temperature (°F)	Precipitation (1/100's in.)	Tendency 43
[illegible]1	08	13	O	15+	IC	014	-10	-12	00	00		008		F BNK W OVR BAY	-01	-05		
[illegible]9	08	13	E5⦶	10	S--	992	07	05	36	10		988	ST 10	CIG LWR W	10	06	02	
09	19	00	5⦶ M10⦶ 100⦶	[illegible]		998	08	05	[illegible]	15	[illegible]	992	ST3 SC4 AC3	DFTG SNW, SUN DMLY VSBL				602
[illegible]5	08	13	-X E 150⦶	[illegible]	F	989	20	20	18	20	F		[illegible]	VSBY VRBL [illegible]	25	15		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	VSBY [illegible]				

AVIATION WEATHER REPORTS

STATION West Fiord MONTH March YEAR 1974 LOCAL TIME

Date(LST) 27	Hour(LST) 28	Hour(GMT) 30	Sky Condition and/or Ceiling (100's ft.) 31	Visibility (miles) 32	Weather and Obstructions To Vision 33	Sea-level Pressure (mb) 34	Dry Bulb Temperature (°F) 35	Dew Point Temperature (°F) 36	Wind Dir. 00 to 36 37A	Wind Speed (mph) 38	Wind Character 39	Altimeter Setting (in.) 40	Clouds and/or Obscuring Phenomena Type, Amount 41	Remarks 42	Max Temperature (°F)	Min Temperature (°F)	Precipitation (1/100's in.)	Tendency 43
1,6	07	1,3	0				-5,2		0,0	,0		0,0,0		VSBY. N.W. 2				
1,6	1,9	0,1	0				-5,0		0,0	,0		9,9,9		Ground fog to NNW 1/2 V. 1/4 mile				
1,7	0,7	1,3	0				-4,8		0,0	,0		0,0,6		Ground fog to NNW.				
1,7	1,9	0,1	0	10			-5,0		0,0	,0		0,1,4		Ground fog to NNW				
1,8	0,7	1,3	0	10			-5,3		0,0	,0		0,1,5		Ground fog to NNW				
1,8	1,9	0,1	0	10			-5,2		0,0	,0		0,2,3		Ground fog to NNW				
1,9	0,7	1,3	ϕ 1/10 13,000 CS	10			-5,0		0,0	,0		0,1,6		Ground fog to NNW				
1,9	1,9	0,1	0	7			-5,1		0,0	,0		0,0,4		Ground fog to NNW				
2,0	0,7	1,3	0	8			-5,0		0,0	,0		9,9,9		Ground fog to NNW				
2,0	1,9	0,1	0	10			-5,0		0,0	,0		9,9,4		Ground fog to NNW				
2,1	0,7	1,3	ϕ 10/10 Ci at 12,000 to S.E.	10			-5,2		0,0	,0		9,9,5		Ground fog to NNW				
2,1	1,9	0,1	0	10			-5,0		0,0	,0		0,1,0		Ground fog to NNW				
2,2	0,1	1,3	0	10			-4,4		0,0	,0		0,2,0		Ground fog to NNW				
2,2	1,8	0,0	ϕ AS 1/10 10000	10			-4,0		1,8	0,2		0,1,1		A.S. to S.E. 10/10				
2,3	0,7	1,3	0	10			-4,1			0,0		9,9,5		~~FG~~				
2,3	1,8	0,6	9/10 AC 10000	10			-2,8			0,0		9,9,5						
2,4	0,7	1,3	9/10 AS 8000	8	S - -		-2,2			0,0		0,0,5						
2,4	1,8	0,0	AC 60 9/10 10000	8			-2,8		1,8	0,2		0,0,4		NS to NW W 8000				
2,5	0,7	1,3		2	S -		-2,8			0,0		0,1,5	X S					
2,5	1,8	0,6	Ci 1/10 15,000	10			-3,0		1,7	0,2		0,2,9						
2,6	0,7	1,3	0	10			-3,0			0,0		0,0,6		Fog to NNW				
2,7	0,7	1,3	0	10			-3,8			0,0		0,0,4		Ground fog to NNW				
2,7	1,8	0,0	0	10			-4,5			0,0		0,0,8		Ground fog to NNW				
2,8	0,7	1,3	0	10			-4,6			0,0		0,0,2		Ground fog to NNW				
2,9	0,7	1,3	0	10			-2,9			0,0		0,2,3						
2,9	1,8	0,0	0	10			-4,0			0,0		0,1,-						
3,0	0,7	1,3	0	10			-3,3			0,0		0,2,4						
3,0	1,8	0,0	0	10			-2,0											

AVIATION WEATHER REPORTS

STATION West Field MONTH March YEAR 1974 LOCAL TIME

Date(LST) 27	Hour(LST) 28	Hour(GMT) 30	Sky Condition and/or Ceiling (100's ft.) 31	Visibility (miles) 32	Weather and Obstructions To Vision 33	Sea-level Pressure (mb) 34	Dry Bulb Temperature (°F) 35	Dew Point Temperature (°F) 36	Wind Dir 00 to 36 37A	Wind Speed (mph) 38	Wind Character 39	Altimeter Setting (in.) 40	Clouds and/or Obscuring Phenomena Type, Amount 41	Remarks 42	Max Temperature (°F)	Min Temperature (°F)	Precipitation (1/100's in.)	Tendency 43
31	07	13	CS 4/10 1000'	10			-30		22	02		992		Ground fog 1.NNW				
31	12	00	0	10			-40		22	01		006						

AVIATION WEATHER REPORTS

STATION West Base MONTH April YEAR 19?1 LOCAL TIME ______

Date (LST) 27	Hour (LST) 28	Hour (GMT) 30	Sky Condition and/or Ceiling (100's ft.) 31	Visibility (miles) 32	Weather and Obstructions To Vision 33	Sea-level Pressure (mb) 34	Dry Bulb Temperature (°F) 35	Dew Point Temperature (°F) 36	Wind Dir. 00 to 36 37A	Wind Speed (mph) 38	Wind Character 39	Altimeter Setting (in.) 40	Clouds and/or Obscuring Phenomena Type, Amount 41	Remarks 42	Max Temperature (°F)	Min Temperature (°F)	Precipitation (1/100's in.)	Tendency 43
01	07	13	0	10			-28			00		20						
01	18	00	CS 5/10 20000	10						00		30						
02	07	13	0	10			-26			00		30						
02	18	00	0	10			-30			00		29						
03	07	13	0	10			-36			00		27						
03	18	00	AC 1/10 15000	10			-38		18	02		22						
04	07	13	0	10			-35			00		19						
04	18	00	X	1/2	-S		-25			00		18		White Out				
05	07	13	0	10			-21		22	01		23						
05	18	00	0	10			-42			00		46		AS 8000 SW 22 NW 32				
06	07	13	0	10			-38			00		76						
06	18	00	CS 1/10 15000	10			-24		34	01		80						
07	07	13	0	10			-38			00		84						
07	18	00	0	10			-34		18	03		82						
08	07	13	0	10			-14			00		65		Ground Fog to NNW				
08	18	00	0	10			-38		18	02		44						
09	07	13	0	10			-15			00		42						
09	18	00	0	10			-25		36	03		29						
10	07	13	AC 18000 1/10	10			-18			00		25						
10	18	00	0	10			-26		18	01		26						
11	07	13	X	10			-20			00		06		Partial white Out to South				
11	18	00	0	10			-20		18	02		93		AS to NNW 10000				
12	07	13	X	1/6	S		-10		34	03		91		White Out				
12	18	00	0	10			[illegible]		00	00		[illegible]						
13	07	13	X	[illegible]	S		-16			00		97		White Out				
13	18	00	X	[illegible]	S		-12		18	01		97		White Out				
14	07	13	AS 10000 4/10	10			-12		18	01		97						
14	18	00	6/10 AS 8000	3 mi	S		-16		36	02	'	98		Patchy to NNW [illegible]				
15	07	13	5/10 AS 8000	[illegible]			-18			00		85						
15	18	00	0	10			[illegible]		18	[illegible]		91						

AVIATION WEATHER REPORTS

STATION West Fjord MONTH April YEAR 1974 LOCAL TIME

Date(LST) 27	Hour(LST) 28	Hour(GMT) 30	Sky Condition and/or Ceiling (100's ft.) 31	Visibility (miles) 32	Weather and Obstructions To Vision 33	Sea-level Pressure (mb) 34	Dry Bulb Temperature (°F) 35	Dew Point Temperature (°F) 36	Wind Dir. 00 to 36 37A	Wind Speed (mph) 38	Wind Character 39	Altimeter Setting (in.) 40	Clouds and/or Obscuring Phenomena Type, Amount 41	Remarks 42	Max Temperature (°F)	Min Temperature (°F)	Precipitation (1/100's in.)	Tendency 43
16	07	13	0	10			-25			00		996						
16	18	00	X				-15			00		003	white out	Vis 10 mi to NNW & 2 mi other Dir				
17	07	13	7/10 CS 12000	10			-26			00		999						
17	18	00	0	6 toNNW			-21		18	03				Fog to NNW & N.				

AVIATION WEATHER REPORTS

STATION Eureka MONTH April YEAR 1974 LOCAL TIME

Date(LST) 27	Hour(LST) 28	Hour(GMT) 30	Sky Condition and/or Ceiling (100's ft.) 31	Visibility (miles) 32	Weather and Obstructions To Vision 33	Sea-level Pressure (mb) 34	Dry Bulb Temperature (°F) 35	Dew Point Temperature (°F) 36	Wind Dir. 00 to 36 37A	Wind Speed (mph) 38	Wind Character 39	Altimeter Setting (in.) 40	Clouds and/or Obscuring Phenomena Type, Amount 41	Remarks 42	Max Temperature (°F)	Min Temperature (°F)	Precipitation (1/100's in.)	Tendency 43
18																		
18																		
19																		
19																		
20																		
20																		
21	08	00	X	5			-02		16	25								
21	18	00	X	5			-02		16	25								
22	08	14					-01					29.71						
22	19	01	5/10 10,000	15			-02		16	10		29.65						
23	07	13	X	5			-03		16	20		29.64						
23	20	02	5/10 10,000	10			-04		18	28		29.54						
24	08	14	O	20			+02		27	05		29.52						
24																		
25	08	14	O	20			+08			00		29.55		V.S to E = 10mi with Sq				
25	18	00	X	10			+01		32	12		29.58						
26	08	14	X	5			+04		35	06		29.56		Fog				
26	18	00	X	15			+10		00	15		29.50						
27	08	14	3/10 10,000	25+			+06		16	03		29.70						
27																		
28	08	14	3/10 10,000	25			+02		27	08		29.70						
28	18	00	4/10 10,000	25					32	08		29.60						
29	07	13		25+			+07		27	08		29.62						
22	17	23	2/10 12,000 T	25+			+20			00		29.28						
30																		
30	17	23	CI	25+														

AVIATION WEATHER REPORTS

STATION EUREKA MONTH MAY YEAR 1974 LOCAL TIME

Date(LST) 27	Hour(LST) 28	Hour (GMT) 30	Sky Condition and/or Ceiling (100's ft.) 31	Visibility (miles) 32	Weather and Obstructions To Vision 33	Sea-level Pressure (mb) 34	Dry Bulb Temperature (°F) 35	Dew Point Temperature (°F) 36	Wind Dir. 00 to 36 37A	Wind (mph) 38	Wind Character 39	Altimeter Setting (in.) 40	Clouds and/or Obscuring Phenomena Type, Amount 41	Remarks 42	Max Temperature (°F)	Min Temperature (°F)	Precipitation (1/100's in.)	Tendency 43
01																		
01	17	23	3/10 10,000	25+			+14			00		29.8						
02	10	16	6/10 5,000	25			+16		15	01		00.3						
02	18	24	5/10 15,000	25			+32		14	06		01.3						
03	07	13	10/10 18,000	25			+18			00		01.2						
03	17	23	X	1/2			+18		90	11		00.8						
04	08	14	O	25			+10		90	00		04.5						
04	17	23	O	25+			+30		90	06		04.2						
05	06	14	O	25+			+15		27	03		01.2						
05																		
06	08	14	X	1/4	B.S.		+10		90	30		02.4						
06																		
07																		
07	15	21	ϕ 12,000				10.8		18	02		05.3						